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A PROPOSITION IN REFERENCE TO CENTRE OF GRAVITY, AND ITS DEMONSTRATION.

By J. W. NICHOLSON, A. M., LL.D., President and Professor of Mathematics, Louisiana State University and Agricultural and Mechanical College, Baton Rouge, Louisiana.

PROPOSITION. The point $P'(x', y', z')$ is the centre of gravity of the mass m if the sum (s) of the squares of the distances from P' to every point of m , is a minimum.

PROOF. Let $P(x, y, z)$ be any point of m , then the square of the distance PP' is $PP'^2 = (x-x')^2 + (y-y')^2 + (z-z')^2$,

$$\text{and } s = \int_{x_1}^{x_2} \int_{y_1}^{y_2} \int_{z_1}^{z_2} [(x-x')^2 + (y-y')^2 + (z-z')^2] dx dy dz.$$

Representing $\int_{x_1}^{x_2} \int_{y_1}^{y_2} \int_{z_1}^{z_2}$ by \int and $dx dy dz$ by dm ,

$$\text{we have } s = \int [(x-x')^2 + (y-y')^2 + (z-z')^2] dm.$$

Since s is a minimum with respect to the independent variables,

x', y', z' , we have $\frac{ds}{dx'} = 0$, $\frac{ds}{dy'} = 0$, and $\frac{ds}{dz'} = 0$; that is,

$$(1). \quad \int (x-x') dm = 0, \quad \therefore \quad x' = \frac{\int x dm}{\int dm};$$

$$(2). \quad \int (y-y') dm = 0, \quad \therefore \quad y' = \frac{\int y dm}{\int dm};$$

$$(3). \quad \int (z-z') dm = 0, \quad \therefore \quad z' = \frac{\int z dm}{\int dm}$$

Q. E. D.